



**National Aeronautics and
Space Administration**

May 6, 1998

NRA-98-OES-06

RESEARCH ANNOUNCEMENT

Regional Earth Science Applications Centers

Letters of Intent Due May 27, 1998

OMB Approval No. 2700-0087

Regional Earth Science Applications Centers

NASA Research Announcement

Soliciting Research Proposals

for

Period Ending

July 8, 1998

NRA 98-OES-06

Issued May 6, 1998

**Office of Earth Science
National Aeronautics and Space Administration
Washington, DC 20546**

1. Purpose

The goal of the National Aeronautics and Space Administration (NASA) Earth Science Enterprise (ESE), formerly the Mission to Planet Earth, is to develop an understanding of the total Earth system and the effects of natural and human-induced changes on the global environment (<http://www.hq.nasa.gov/office/mtpe/>). The attainment of this goal is being pursued through a series of spacecraft and other remote sensing platforms and *in situ* measurement capabilities to acquire data; data and information management systems to capture, process, archive and distribute global data sets; and science research and analysis programs to convert data into new knowledge of the Earth system.

The science results and data products that emerge from this research are intended to develop an improved scientific understanding of global climate change and variability and provide a more informed basis for policy decision-making in the future. In addition to their value to global change scientists, the resulting science results and data products have significant potential applications value to a variety of user communities who require and work with spatially oriented data to carry out their everyday responsibilities in solving more near-term problems. These communities include resource managers in Federal agencies, state and local government, end-users in private industry, non-governmental organizations and value-added companies.

The purpose of this NASA Research Announcement (NRA) is to solicit proposals for the establishment of Regional Earth Science Applications Centers (RESACs) designed to apply remote sensing and attending technologies¹ to well-defined problems and issues of regional significance. Within the scope of this NRA, there are two types of problems that might be addressed:

1. Multisectoral, region-specific studies covering sets of issues that have been identified by the user community as having economic and policy consequence to their region, such as those that have arisen through the Regional Workshops of the U.S. Global Change Research Program (USGCRP; <http://www.usgcrp.gov>). Regional assessments are now being initiated to determine the potential consequences of global climate change/variability and to identify impacts and response options. RESACs may provide critical support to one or more of these regional assessments.
2. Sector-specific problems that are associated with an easily-identified user community covering a broad region (e.g., forest managers of the Southeast; water resource managers of the Southwest; urban and regional planners of the Northeast; farmers and ranchers of the Great Plains). Appendix G identifies key sectors and their potential scope as developed by the USGCRP's National Assessment process. RESACs might assist the USGCRP National Assessment in study of one or more of the sectors and/or might address an applications problem, or set of related applications problems, that confronts the selected community or sector (e.g., stream flow predictions for real-time use by water resource managers).

¹ "Remote sensing" refers to the measurements made by instruments carried on satellites and aircraft described in Appendix F, and the various processes used to extract information from them. "Attending technologies" refers to the wide array of tools for acquiring, managing, and analyzing spatial data (e.g., Global Positioning Systems; Geographic Information Systems), models that may be driven by remote sensing measurements (e.g., hydrologic models for predicting stream flows), and the combination of tools that might be assembled for specific practical purposes (e.g., decision support systems).

The total amount of funds available for establishment of the RESACs is \$13 million over three years. Five or more centers will be funded. Funding levels for selected RESACs will range from \$400K to \$850K per year. A range of diversity in the level of funding is expected for the RESACs that are finally selected.

2. Earth Science Applications Research Program

In addition to building improved scientific understanding, ESE contributes to enabling near-term economic and societal payoffs from the public's investment through the Earth Science Applications Research Program (ESARP). The goal of ESARP is to extend the uses of Earth science research, information and products beyond the needs of global change research to a broader user community, including other Federal agencies, state, and local governments, value-added companies, private sector users, and various non-governmental organizations (NGOs). In this process, ESARP helps to define the needs of the broader user community and identify space assets and science results that can meet those needs.

The objectives of the ESARP are to: (1) to capture and understand the practical Earth Science information needs of the non-science community; (2) to mobilize enterprise-wide expertise in science and technology through a program of Applications Research driven by user needs; (3) to extend the benefits of ESE science results, data and expertise to the broader user community.

This NRA is an integral part of the ESARP and responds to the challenge to develop new methods for bringing together the research, service, and end-user communities to develop and apply ESE science and information to practical problems. In doing so, the NRA also provides a major vehicle to solicit proposals designed to conduct regional assessments in support of and cooperation with the on-going USGCRP National Assessment.

3. Objectives

Within the general framework outlined above, all proposals should respond to the following objectives:

- Establish dynamic, integrated, “end-to-end” partnerships among the research, service, and end-user communities to apply remote sensing and its attending technologies to well-defined problems of significant regional economic or policy consequence;
- Integrate remote sensing and its attending technologies into resource management and decision-making processes in the public and private sectors;
- Build on existing and planned capabilities in the application of remote sensing and attending technologies;
- Create a broader dialog among the research, service, and end-user communities regarding remote sensing products and potential applications.

4. Approach

4.1 Organization

When finally selected, the array of RESACs should be distributed geographically to ensure national coverage and diversity for the program. They shall be operated by public/private consortia and should be constituted as “end-to-end” partnerships drawn from the research, service and end-user communities. “End-to-end” implies that all participants involved at each stage from research, to data analysis and reporting, to decision making, are integrated in each step of the activity. Based upon the focus of a proposed RESAC, participants in the consortium may include appropriate Federal, state and local agencies, universities, non-governmental organizations, non-profit organizations, private companies and individuals. Consortia are encouraged to include individuals or organizations that have not previously participated in ESE activities.

Partnerships among participants should be based on relationships among agencies, organizations, universities, companies and individuals in which the roles of each are clear and well-defined. These may be based on long-established arrangements (e.g., extension or outreach relationships between universities and state agencies) or they may be based on new or emerging alignments of common interest (e.g., teaming arrangements and working groups that have been formulated as a result of the USGCRP Regional Workshops).

4.2 Focus

RESACs should have two primary foci. First, RESACs should focus on developing new methods and modalities for bringing together the research, service, and end-user communities to address user-defined problems. Thus, not only should specific technical problems be addressed but also the ways in which the participants organize themselves to deal with them effectively and efficiently.

Second, RESACs should focus on developing and applying remote sensing and attending tools to regional problems of significant economic or policy consequence. The overall intent of establishing the RESAC is to mitigate start-up risks associated with finding new solutions to pressing problems and bringing recent Earth science research, information and products into routine use. The risks to be taken and long term benefits that might be realized should be made explicit. The analytical methods employed should be new, or new applications of existing methods. As outlined in section 1, the applications problem area focus should be either defined in terms of (1) a regional assessment in support of the USGCRP National Assessment, or (2) a sector-specific problem or set of problems.

End users are expected to identify problems to be addressed and establish their priorities to ensure that problems of broad significance are pursued. All consortia partners are expected to participate in defining objectives, developing an approach, and establishing performance measures. This is intended to strengthen the general approach and enhance the likelihood of success and continued operation of the RESAC at conclusion of performance under the agreement.

4.3 Management

Cost sharing by participating consortia members is not required but is encouraged. Consortia should develop plans to demonstrate their approach to becoming self-sustaining at the end of the 3 years and not require continued NASA funding. A self-sustaining status

can be achieved through an evolution to a for-profit business or through the follow-up funding (e.g., another Federal agency, state government, non-profit organization) other than NASA.

The management of the selected RESAC projects will be carried out by the ESARP Program in the Applications and Outreach Division, Office of Earth Science (OES) at NASA Headquarters.

4.4 Outreach

Each RESAC is expected to develop an outreach plan that uses “non-traditional” media to familiarize new audiences with ESE science and data (e.g., popular journals; broadcast). Because of its rapidly growing importance as a medium for information exchange among businesses and government agencies, each RESAC is expected to create and maintain a Home Page on the World Wide Web that is expected to be linked to the ESE Home Page. This is aimed at ensuring that results reach the widest possible audience, particularly those who may be unfamiliar with the ESE enterprise.

4.5 Reporting

Each RESAC is expected to develop performance metrics which shall be required for each RESAC to assess project progress as part of Annual Review (Inputs, Outputs, Outcome and Impact). As outlined above, these metrics are expected to be established by all partners. Each RESAC is expected to hold an annual “Significant Results” conference to share results and facilitate user outreach. An annual progress report should be prepared by each RESAC, and should include an assessment of performance against adopted metrics. A more detailed explanation of Project Performance Metrics is included as Attachment G.

5. Guidance for Proposers

5.1 Evaluation Criteria

The following criteria will be used to evaluate proposals. Criteria 5.1.1 and 5.1.3 have equal weight and are more heavily weighted than criterion 5.1.2.

5.1.1 Technical approach

- The suitability of the proposed application (or set of applications) in terms of addressing issues identified in the assessment process or its regional significance, and the probability of meeting stated objectives;
- The feasibility, soundness, logic and practicality of the proposed technical methods and concepts for achieving successful applications research and in advancing the regional assessment process;
- The clear identification of user needs and benefits from proposed products or services for the target user(s);

- The clear definition of partners and their respective roles within the consortium;
- The centrality of remote sensing and its attending technologies to achieving project objectives.

5.1.2 Cost effectiveness and benefits

- The potential value of the products and services (i.e., cost/benefit and regional applications benefits) to the targeted user community;
- The likelihood that the effort will become self-sustaining.

5.1.3 Management and experience

- The feasibility of the management approach along with the methods and concepts demonstrated by the proposal;
- The feasibility of the outreach plan and the soundness of the philosophy and methods by which it is effected;
- Evidence that the proposed plan will effectively communicate regional applications and regional assessment results to the broader user community;
- The demonstrated competence and relevant experience of the proposers as an indication of their ability to carry the proposed activity to a successful conclusion (the proposal must show the qualifications and capabilities of the Project Lead, management team, and key personnel relevant to the success of the proposed activity);
- The adequacy of the facilities and equipment to support the proposed activity;
- The adequacy of metrics and other statistics to be collected that will measure the success of the activity.

5.2 Schedule

Letters of Intent Due	May 27, 1998
Proposals Due	July 8, 1998
Selections Announced	September, 1998
Agreements Awarded	November, 1998

5.3 Eligibility

Investigators at scientific research, educational institutions, public (NASA centers included) and private agencies or organizations and commercial entities in the U.S. are eligible to apply for funding under this NRA. Investigators from similar institutions, agencies, organizations, and/or entities in other countries are eligible to apply for participation in a RESAC consortium under this NRA on a no-exchange-of-funds basis. NASA specifically encourages researchers in other U.S. government agencies with remote sensing applications responsibilities to participate as members in no-cost or low-cost applications, but notes that civil servants may not request salary reimbursement. Civil servants in other U.S. government research laboratories are eligible to apply, but also may not request salary reimbursement.

5.4 Proposal Submission and Review

Proposals may be up to fifteen pages of text, single-spaced, 12-pt. type, including references. A single cover page with the research title, name and contact information of the Principal Investigator(s) and any co-investigators, and detailed budget information are not included in this total. A reasonable number of figures and tables (no more than 5 pages) may be appended. Full proposals will be mailed to at least three independent peer reviewers who will be asked to evaluate them on the basis of their relevance to NASA's objectives, intrinsic merit, stated performance metrics and cost. Evaluation criteria for the proposals are provided in Section 5.1.

Proposals must contain a *Budget Summary* (form given in Appendix E) for each year of the proposed effort filled out in accordance with the *Instructions for Budget Summary* on the page that follows it. Special attention is directed to the discussion of item 2.c. *Equipment* on the *Instructions* sheet regarding the proposed purchase of personal computers and/or commercially available software, both of which are considered to be "general purpose equipment." In the event that a proposal is selected for award, failure to adequately address the provisions of the instructions for item 2.c will require that the NASA awards office contact the proposing institution for the required information, which may delay the award until the purchase is either justified as a direct charge for general purpose equipment or is rebudgeted as an indirect expense.

Any negotiations prior to final decisions will occur only after the mail reviews of proposals have been received. Final decisions will be made promptly and investigators will be notified through both electronic mail and surface mail. All proposers will receive anonymous copies of review comments from the mail reviewers.

Proposals will be considered for periods of performance of three years. NASA anticipates being able to make approximately 5 to 10 awards with annual budgets in the \$400 to \$850K range. Because of the important nature of the NRA, proposers should budget for one team meeting per year, to be held in the Washington, DC area. The first team meeting will be held as soon as possible following award of the cooperative agreements for the RESACs.

Additional information is provided in Appendices A-H of this Announcement.

Appendix A contains the basic guidance needed for proposal preparation in response to this announcement. Note that when requirements listed in Sections 1 through 5 in the front part of this NRA overlap with the similar requirements in Appendix A, the requirements in Sections 1 through 5 take precedence. Appendix B provides guidance for international participation. Appendix C provides the list of required declarations and the proposal cover

sheet. Appendix D provides the notice of intent to propose. The budget form and its instructions are in Appendix E. Appendix F contains material on NASA aircraft, EOS sensors, and data systems availability. Appendix G lists the multisectoral issues that have emerged through the Regional Workshops and the USGCRP, and Appendix H provides information on Project Performance Metrics.

Note that URL addresses for accessing home pages with relevant information to this NRA are provided within this document. If electronic access is not available to the prospective proposers, a hard copy of relevant reference(s) can be requested through the points of contact identified below.

Identifier: NRA 98-OES-06

Submit Proposals to:

Regional Earth Science Applications Centers
Code Y
400 Virginia Avenue, SW, Suite 700
Washington, DC 20024
202-554-2775

Copies required: 10

Selecting Official: Associate Administrator,
Office of Earth Science

To obtain additional general information:

Mr. Alexander J. Tuyahov
Manager, Earth Science Applications Research Program (ESARP)
NASA HQ
Code YO
300 E St., SW
Washington, DC 20456
Phone: 202-358-0250
Fax: 202-358-3098
email: atuyahov@hq.nasa.gov

or

Douglas R. Kahle
Phone: (202) 358-0745
Fax: (202) 358-2769
email: dkahle@hq.nasa.gov

Your interest and cooperation in participating in this opportunity are appreciated.

Ghassem R. Asrar
Associate Administrator for
Earth Science

Enclosures:

Appendix A, "Instructions for Responding to NASA Research Announcements"
Appendix B, "Guidelines for International Proposals"
Appendix C, "Required Declarations and proposal Cover Sheet"
Appendix D, "Notice of Intent to Propose"
Appendix E, "Budget Summary"
Appendix F, "Supporting Facilities"
Appendix G, "USGCRP Issues"
Appendix H, "Project Performance Metrics"

APPENDIX A

INSTRUCTIONS FOR RESPONDING TO NASA RESEARCH ANNOUNCEMENTS

Part 1852.235-72

NASA Federal Acquisition Regulations (FAR) Supplement (NFS)
Version 89.90, Effective January 1997.

Accessible

<<http://www.hq.nasa.gov/office/procurement/regs/nfstoc.htm>>,
open 'Part 1852.228 to 1852.241' from menu.

(a). General.

(1) Proposals received in response to a NASA Research Announcement (NRA) will be used only for evaluation purposes. NASA does not allow a proposal, the contents of which are not available without restriction from another source, or any unique ideas submitted in response to an NRA to be used as the basis of a solicitation or in negotiation with other organizations, nor is a preaward synopsis published for individual proposals.

(2) A solicited proposal that results in a NASA award becomes part of the record of that transaction and may be available to the public on specific request; however, information or material that NASA and the awardee mutually agree to be of a privileged nature will be held in confidence to the extent permitted by law, including the Freedom of Information Act.

(3) NRA's contain programmatic information and certain requirements which apply only to proposals prepared in response to that particular announcement. These instructions contain the general proposal preparation information which applies to responses to all NRA's.

(4) A contract, grant, cooperative agreement, or other agreement may be used to accomplish an effort funded in response to an NRA. NASA will determine the appropriate instrument. Contracts resulting from NRA's are subject to the Federal Acquisition Regulation (FAR) and the NASA FAR Supplement (NFS). Any resultant grants or cooperative agreements will be awarded and administered in accordance with the NASA Grant and Cooperative Agreement Handbook (NPG 5800.1).

(5) NASA does not have mandatory forms or formats for responses to NRA's; however, it is requested that proposals conform to the guidelines in these instructions. NASA may accept proposals without discussion; hence, proposals should initially be as complete as possible and be submitted on the proposers' most favorable terms.

(6) To be considered for award, a submission must, at a minimum, present a specific project within the areas delineated by the NRA; contain sufficient technical and cost information to permit a meaningful evaluation; be signed by an official authorized to legally bind the submitting organization; not merely offer to perform standard services or to just provide computer facilities or services; and not significantly duplicate a more specific current or pending NASA solicitation.

(b). NRA-Specific Items. Several proposal submission items appear in the NRA itself: the unique NRA identifier, when to submit proposals, where to send proposals, number of copies required, and sources for more information. Items included in these instructions may be supplemented by the NRA.

(c). Proposal Content. The following information is needed to permit consideration in an objective manner. NRA's will generally specify topics for which additional information or greater detail is desirable. Each proposal copy shall contain all submitted material, including a copy of the transmittal letter if it contains substantive information.

(1) *Transmittal Letter or Prefatory Material*.

(i) The legal name and address of the organization and specific division or campus identification, if part of a larger organization;

(ii) A brief, scientifically valid project title intelligible to a scientifically literate reader and suitable for use in the public press;

(iii) Type of organization: e.g., profit, nonprofit, educational, small business, minority, women-owned, etc.;

(iv) Name and telephone number of the principal investigator and business personnel who may be contacted during evaluation or negotiation;

(v) Identification of other organizations that are currently evaluating a proposal for the same efforts;

(vi) Identification of the NRA, by number and title, to which the proposal is responding;

(vii) Dollar amount requested, desired starting date, and duration of project;

(viii) Date of submission; and

(ix) Signature of a responsible official or authorized representative of the organization, or any other person authorized to legally bind the organization(unless the signature appears on the proposal itself).

(2) *Restriction on Use and Disclosure of Proposal Information*. Information contained in proposals is used for evaluation purposes only. Offerors or quoters should, in order to maximize protection of trade secrets or other information that is confidential or privileged, place the following Notice on the title page of the proposal and specify the information subject to the notice by inserting an appropriate identification in the Notice. In any event, information contained in proposals will be protected to the extent permitted by law, but NASA assumes no liability for use and disclosure of information not made subject to the Notice.

Notice

Restriction on Use and Disclosure of Proposal Information

The information (data) contained in [insert page numbers or other identification] of this proposal constitutes a trade secret and/or information

that is commercial or financial and confidential or privileged. It is furnished to the Government in confidence with the understanding that it will not, without permission of the offeror, be used or disclosed other than for evaluation purposes; provided, however, that in the event a contract(or other agreement) is awarded on the basis of this proposal, the Government shall have the right to use and disclose this information (data) to the extent provided in the contract(or other agreement). This restriction does not limit the Government's right to use or disclose this information (data) if obtained from another source without restriction.

(3) *Abstract.* Include a concise (200-300 word if not otherwise specified in the NRA) abstract describing the objective and the method of approach.

(4) *Project Description.*

(i) The main body of the proposal shall be a detailed statement of the work to be undertaken and should include objectives and expected significance, relation to the present state of knowledge, and relation to previous work done on the project and to related work in progress elsewhere. The statement should outline the plan of work, including the broad design of experiments to be undertaken and a description of experimental methods and procedures. The project description should address the evaluation factors in these instructions and any specific factors in the NRA. Any substantial collaboration with individuals not referred to in the budget or use of consultants should be described. Subcontracting significant portions of a research project is discouraged.

(ii) When it is expected that the effort will require more than one year, the proposal should cover the complete project to the extent that it can be reasonably anticipated. Principal emphasis should be on the first year of work, and the description should distinguish clearly between the first year's work and work planned for subsequent years.

(5) *Management Approach.* For large or complex efforts involving interactions among numerous individuals or other organizations, plans for distribution of responsibilities and arrangements for ensuring a coordinated effort should be described.

(6) *Personnel.* The principal investigator is responsible for supervision of the work and participates in the conduct of the research regardless of whether or not compensated under the award. A short biographical sketch of the principal investigator, a list of principal publications, and any exceptional qualifications should be included. Omit social security number and other personal items which do not merit consideration in evaluation of the proposal. Give similar biographical information on other senior professional personnel who will be directly associated with the project. Give the names and titles of any other scientists and technical personnel associated substantially with the project in an advisory capacity. Universities should list the approximate number of students or other assistants, together with information as to their level of academic attainment. Any special industry-university cooperative arrangements should be described.

(7) *Facilities and Equipment.*

(i) Describe available facilities and major items of equipment especially adapted or suited to the proposed project, and any additional major equipment that will be

required. Identify any Government-owned facilities, industrial plant equipment, or special tooling that are proposed for use. Include evidence of its availability and the cognizant Government points of contact.

(ii) Before requesting a major item of capital equipment, the proposer should determine if sharing or loan of equipment already within the organization is a feasible alternative. Where such arrangements cannot be made, the proposal should so state. The need for items that typically can be used for research and non research purposes should be explained.

(8) *Proposed Costs.*

(i) Proposals should contain cost and technical parts in one volume: do not use separate "confidential" salary pages. As applicable, include separate cost estimates for salaries and wages, fringe benefits, equipment, expendable materials and supplies, services, domestic and foreign travel, ADP expenses, publication or page charges, consultants, subcontracts, other miscellaneous identifiable direct costs, and indirect costs. List salaries and wages in appropriate organizational categories (e.g., principal investigator, other scientific and engineering professionals, graduate students, research assistants, and technicians and other non-professional personnel). Estimate all staffing data in terms of staff-months or fractions of full-time.

(ii) Explanatory notes should accompany the cost proposal to provide identification and estimated cost of major capital equipment items to be acquired, purpose and estimated number and lengths of trips planned, basis for indirect cost computation (including date of most recent negotiation and cognizant agency), and clarification of other items in the cost proposal that are not self-evident. List estimated expenses as yearly requirements by major work phases.

(iii) Allowable costs are governed by FAR Part 31 and the NASA FAR Supplement Part 1831 (and OMB Circulars A-21 for educational institutions and A-122 for nonprofit organizations).

(9) *Security.* Proposals should not contain security classified material. If the research requires access to or may generate security classified information, the submitter will be required to comply with Government security regulations.

(10) *Current Support.* For other current projects being conducted by the principal investigator, provide title of project, sponsoring agency, and ending date.

(11) *Special Matters.*

(i) Include any required statements of environmental impact of the research, human subject or animal care provisions, conflict of interest, or on such other topics as may be required by the nature of the effort and current statutes, executive orders, or other current Government-wide guidelines.

(ii) Proposers should include a brief description of the organization, its facilities, and previous work experience in the field of the proposal. Identify the cognizant Government audit agency, inspection agency, and administrative contracting officer, when applicable.

(d). Renewal Proposals

(1) Renewal proposals for existing awards will be considered in the same manner as proposals for new endeavors. A renewal proposal should not repeat all of the information that was in the original proposal. The renewal proposal should refer to its predecessor, update the parts that are no longer current, and indicate what elements of the research are expected to be covered during the period for which support is desired. A description of any significant findings since the most recent progress report should be included. The renewal proposal should treat, in reasonable detail, the plans for the next period, contain a cost estimate, and otherwise adhere to these instructions.

(2) NASA may renew an effort either through amendment of an existing contract or by a new award.

(e). Length. Unless otherwise specified in the NRA, effort should be made to keep proposals as brief as possible, concentrating on substantive material. Few proposals need exceed 15-20 pages. Necessary detailed information, such as reprints, should be included as attachments. A complete set of attachments is necessary for each copy of the proposal. As proposals are not returned, avoid use of "one-of-a-kind" attachments.

(f). Joint Proposals.

(1) Where multiple organizations are involved, the proposal may be submitted by only one of them. It should clearly describe the role to be played by the other organizations and indicate the legal and managerial arrangements contemplated. In other instances, simultaneous submission of related proposals from each organization might be appropriate, in which case parallel awards would be made.

(2) Where a project of a cooperative nature with NASA is contemplated, describe the contributions expected from any participating NASA investigator and agency facilities or equipment which may be required. The proposal must be confined only to that which the proposing organization can commit itself. "Joint" proposals which specify the internal arrangements NASA will actually make are not acceptable as a means of establishing an agency commitment.

(g). Late Proposals. A proposal or modification received after the date or dates specified in an NRA may be considered if doing so is in the best interests of the Government.

(h). Withdrawal. Proposals may be withdrawn by the proposer at any time before award. Offerors are requested to notify NASA if the proposal is funded by another organization or of other changed circumstances which dictate termination of evaluation.

(i). Evaluation Factors

(1) Unless otherwise specified in the NRA (see Section 5.1 in NRA), the principal elements (of approximately equal weight) considered in evaluating a proposal are its relevance to NASA's objectives, intrinsic merit, and cost.

(2) Evaluation of a proposal's relevance to NASA's objectives includes the consideration of the potential contribution of the effort to NASA's mission.

(3) Evaluation of its intrinsic merit includes the consideration of the following factors of equal importance:

- (i) Overall scientific or technical merit of the proposal or unique and innovative methods, approaches, or concepts demonstrated by the proposal.
 - (ii) Offeror's capabilities, related experience, facilities, techniques, or unique combinations of these which are integral factors for achieving the proposal objectives.
 - (iii) The qualifications, capabilities, and experience of the proposed principal investigator, team leader, or key personnel critical in achieving the proposal objectives.
 - (iv) Overall standing among similar proposals and/or evaluation against the state-of-the-art.
- (4) Evaluation of the cost of a proposed effort may include the realism and reasonableness of the proposed cost and available funds.
- (j). Evaluation Techniques. Selection decisions will be made following peer and/or scientific review of the proposals. Several evaluation techniques are regularly used within NASA. In all cases, proposals are subject to scientific review by discipline specialists in the area of the proposal. Some proposals are reviewed entirely in-house, others are evaluated by a combination of in-house and selected external reviewers, while yet others are subject to the full external peer review technique (with due regard for conflict-of-interest and protection of proposal information), such as by mail or through assembled panels. The final decisions are made by a NASA selecting official. A proposal which is scientifically and programmatically meritorious, but not selected for award during its initial review, may be included in subsequent reviews unless the proposer requests otherwise.
- (k). Selection for Award.
- (1) When a proposal is not selected for award, the proposer will be notified. NASA will explain generally why the proposal was not selected. Proposers desiring additional information may contact the selecting official who will arrange a debriefing.
 - (2) When a proposal is selected for award, negotiation and award will be handled by the procurement office in the funding installation. The proposal is used as the basis for negotiation. The contracting officer may request certain business data and may forward a model award instrument and other information pertinent to negotiation.
- (l). Cancellation of NRA. NASA reserves the right to make no awards under this NRA and to cancel this NRA. NASA assumes no liability for canceling the NRA or for anyone's failure to receive actual notice of cancellation.

APPENDIX B

GUIDELINES FOR FOREIGN PARTICIPATION

NASA accepts proposals containing non-U.S. participation as part of a potential RESAC consortium in response to this NRA. Potential non-U.S. participants will not be funded through this NRA, and must be endorsed by the respective government agency or funding/sponsoring institution in the country from which the non-U.S. participant is proposing. Such endorsement should indicate the following points: (1) The proposal merits careful consideration by NASA; and (2) If the proposal is selected, sufficient funds will be made available by the sponsoring foreign agency to undertake the activity as proposed.

Such proposals, along with the requested number of copies and Letter of Endorsement must be forwarded to NASA in time to arrive before the deadline established for this NRA. In addition, one copy of each of these documents should be sent to:

NASA Headquarters
Office of External Relations
Earth Science Division, Code IY
Washington, DC 20546
USA

Any materials sent by courier or express mail should include the street address 300 E Street, S. W., and substitute 20024 for the indicated ZIP code.

All proposals must be typewritten in English. U.S. Proposals that include non-U.S. participation, must follow all other guidelines and requirements described in this NRA.

Successful and unsuccessful proposers will be contacted directly by the NASA Program Office coordinating the NRA. Copies of these letters will be sent to the sponsoring government agency.

APPENDIX C, Part 1

Proposal Cover Sheet

NASA Research Announcement 98-OES-06

Proposal No. _____ (Leave Blank for NASA Use)

Title: _____

Principal Investigator::_____

Department:_____

Institution: _____

Street/PO Box: _____

City: _____ State: _____ Zip: _____

Country: _____ E-mail: _____

Telephone: _____ Fax: _____

Co-Investigators:

Name	Institution	Telephone
_____	_____	_____
_____	_____	_____
_____	_____	_____

Budget:

1st Year: _____ 2nd Year: _____ 3rd Year: _____ Total: _____

Certification of Compliance with Applicable Executive Orders and U.S. Code

By submitting the proposal identified in this *Cover Sheet/Proposal Summary* in response to NRA 98-OSS-03, the Authorizing Official of the proposing institution (or the individual proposer if there is no proposing institution) as identified below:

- certifies that the statements made in this proposal are true and complete to the best of his/her knowledge;
- agrees to accept the obligations to comply with NASA award terms and conditions if an award is made as a result of this proposal; and
- confirms compliance with all provisions, rules, and stipulations set forth in the two Certifications contained in this NRA [namely, (i) *Certification of Compliance with the NASA Regulations Pursuant to Nondiscrimination in Federally Assisted Programs, and* (ii) *Certifications, Disclosures, And Assurances Regarding Lobbying, Debarment & Suspension, And Drug-Free Workplace Requirements*].

Willful provision of false information in this proposal and/or its supporting documents, or in reports required under an ensuing award, is a criminal offense (U.S. Code, Title 18, Section 1001).

Title of Authorizing Institutional Official: _____

Signature: _____ Date: _____

Name of Proposing Institution: _____

Telephone: _____ E-mail: _____ Facsimile: _____

APPENDIX C, Part 2

Certification of Compliance with the NASA Regulations Pursuant to Nondiscrimination in Federally Assisted Programs

The (*Institution, corporation, firm, or other organization on whose behalf this assurance is signed, hereinafter called "Applicant "*) hereby agrees that it will comply with Title VI of the Civil Rights Act of 1964 (P.L. 88-352), Title IX of the Education Amendments of 1962 (20 U.S.C. 1680 et seq.), Section 504 of the Rehabilitation Act of 1973, as amended (29 U.S.C. 794), and the Age Discrimination Act of 1975 (42 U.S.C. 16101 et seq.), and all requirements imposed by or pursuant to the Regulation of the National Aeronautics and Space Administration (14 CFR Part 1250) (hereinafter called "NASA") issued pursuant to these laws, to the end that in accordance with these laws and regulations, no person in the United States shall, on the basis of race, color, national origin, sex, handicapped condition, or age be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination under any program or activity for which the Applicant receives federal financial assistance from NASA; and hereby give assurance that it will immediately take any measure necessary to effectuate this agreement.

If any real property or structure thereon is provided or improved with the aid of federal financial assistance extended to the Applicant by NASA, this assurance shall obligate the Applicant, or in the case of any transfer of such property, any transferee, for the period during which the real property or structure is used for a purpose for which the federal financial assistance is extended or for another purpose involving the provision of similar services or benefits. If any personal property is so provided, this assurance shall obligate the Applicant for the period during which the federal financial assistance is extended to it by NASA.

this assurance is given in consideration of and for the purpose of obtaining any and all federal grants, loans, contracts, property, discounts, or other federal financial assistance extended after the date hereof to the Applicant by NASA, including installment payments after such date on account of applications for federal financial assistance which were approved before such date. The Applicant recognized and agrees that such federal financial assistance will be extended in reliance on the representations and agreements made in this assurance, and that the United States shall have the right to seek judicial enforcement of this assurance. This assurance is binding on the Applicant, its successors, transferees, and assignees, and the person or persons whose signatures appear below are authorized to sign on behalf of the Applicant.

NASA FORM 1206

APPENDIX C, Part 3

CERTIFICATIONS, DISCLOSURES, AND ASSURANCES REGARDING LOBBYING, DEBARMENT & SUSPENSION, AND DRUG-FREE WORKPLACE REQUIREMENTS

1. LOBBYING

As required by Section 1352, Title 31 of the U.S. Code, and implemented at 14 CFR Part 1271, as defined at 14 CFR Subparts 1271.110 and 1260.117, with each submission that initiates agency consideration of such applicant for award of a Federal contract, grant, or cooperative agreement exceeding \$ 100,000, the applicant must **certify** that:

(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned to any person for influencing or attempting to influence an officer or employee of an agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit a Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

(3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

2. DRUG-FREE WORKPLACE

The applicant **agrees** that it will or will continue to provide a drug-free workplace as required by the Drug-Free Workplace Act of 1988, P.L. 100-690, as amended.

3. GOVERNMENTWIDE DEBARMENT AND SUSPENSION

As required by Executive Order 12549, and implemented at 14 CFR 1260.510, for prospective participants in primary covered transactions, as defined at 14 CFR Subparts 1265.510 and 1260.117—

(1) The prospective primary participant **certifies** to the best of its knowledge and belief, that it and its principals:

(a) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded by any Federal department or agency.

(b) Have not within a three-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;

(c) Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State or local) with commission of any of the offenses enumerated in paragraph (1)(b) of this certification; and

(d) Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State or local) terminated for cause or default.

(2) Where the prospective primary participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

NASA Office of Equal Opportunity Programs (OEOP)
Minority University Research and Education Division (MURED)

February, 1998

APPENDIX D

Letter of Intent

All prospective proposers are strongly encouraged to submit a letter of intent in response to this announcement. This will allow us to alert a peer review staff to adequately cover the proposal review process. This letter of intent is available electronically via the Internet at URL: <http://www.mtpe.hq.nasa.gov/LOI/form.html>. The URL for the Co-Investigator information is: <http://www.mtpe.hq.nasa.gov/LOI/coi.html>. We urge you to use these electronic letter of intent forms unless you do not have access to the Internet. In that case, we will accept a FAX copy sent to 202-554-3024 with the following information:

- PI and CoI names and addresses, (including Zip + 4);
- Title of proposal;
- Telephone number;
- Fax number;
- Email address; and
- A brief summary of what you plan to propose (Please limit this to no more than 3000 characters).

APPENDIX E:

BUDGET SUMMARY

For period from _____ to _____

- Provide a complete Budget Summary for year one and separate estimated for each subsequent year.
- Enter the proposed estimated costs in Column A (Columns B & C for NASA use only).
- Provide as attachments detailed computations of all estimates in each cost category with narratives as required to fully explain each proposed cost. See *Instructions For Budget Summary* on following page for details.

	A	NASA USE ONLY	
		B	C
1. <u>Direct Labor</u> (salaries, wages, and fringe benefits)	_____	_____	_____
2. <u>Other Direct Costs</u> :			
a. Subcontracts	_____	_____	_____
b. Consultants	_____	_____	_____
c. Equipment	_____	_____	_____
d. Supplies	_____	_____	_____
e. Travel	_____	_____	_____
f. Other	_____	_____	_____
3. <u>Facilities and Administrative Costs</u>	_____	_____	_____
4. <u>Other Applicable Costs</u> :	_____	_____	_____
5. <u>SUBTOTAL--Estimated Costs</u>	_____	_____	_____
6. <u>Less Proposed Cost Sharing</u> (if any)	_____	_____	_____
7. <u>Carryover Funds</u> (if any)			
a. Anticipated amount : _____			
b. Amount used to reduce budget _____			
8. <u>Total Estimated Costs</u>	_____	_____	XXXXXXX
9. APPROVED BUDGET	XXXXXXX	XXXXXXX	_____

INSTRUCTIONS FOR BUDGET SUMMARY

1. **Direct Labor (salaries, wages, and fringe benefits):** Attachments should list the number and titles of personnel, amounts of time to be devoted to the grant, and rates of pay.
2. **Other Direct Costs:**
 - a. **Subcontracts:** Attachments should describe the work to be subcontracted, estimated amount, recipient (if known), and the reason for subcontracting.
 - b. **Consultants:** Identify consultants to be used, why they are necessary, the time they will spend on the project, and rates of pay (not to exceed the equivalent of the daily rate for Level IV of the Executive Schedule, exclusive of expenses and indirect costs).
 - c. **Equipment:** List separately. Explain the need for items costing more than \$5,000. Describe basis for estimated cost. General purpose equipment is not allowable as a direct cost unless specifically approved by the NASA Grant Officer. Any equipment purchase requested to be made as a direct charge under this award must include the equipment description, how it will be used in the conduct of the basic research proposed and why it cannot be purchased with indirect funds.
 - d. **Supplies:** Provide general categories of needed supplies, the method of acquisition, and the estimated cost.
 - e. **Travel:** Describe the purpose of the proposed travel in relation to the grant and provide the basis of estimate, including information on destination and number of travelers where known.
 - f. **Other:** Enter the total of direct costs not covered by 2a through 2e. Attach an itemized list explaining the need for each item and the basis for the estimate.
3. **Facilities and Administrative (F&A) Costs:** Identify F&A cost rate(s) and base(s) as approved by the cognizant Federal agency, including the effective period of the rate. Provide the name, address, and telephone number of the Federal agency official having cognizance. If unapproved rates are used, explain why, and include the computational basis for the indirect expense pool and corresponding allocation base for each rate.
4. **Other Applicable Costs:** Enter total explaining the need for each item.
5. **Subtotal-Estimated Costs:** Enter the sum of items 1 through 4.
6. **Less Proposed Cost Sharing (if any):** Enter any amount proposed. If cost sharing is based on specific cost items, identify each item and amount in an attachment.
7. **Carryover Funds (if any):** Enter the dollar amount of any funds expected to be available for carryover from the prior budget period. Identify how the funds will be used if they are not used to reduce the budget. NASA officials will decide whether to use all or part of the anticipated carryover to reduce the budget (not applicable to 2nd-year and subsequent-year budgets submitted for award of a multiple year award).
8. **Total Estimated Costs:** Enter the total after subtracting items 6 and 7b from item 5.

APPENDIX F: SUPPORTING FACILITIES

1. AIRBORNE INSTRUMENTS

The National Aeronautics and Space Administration maintains a variety of aircraft and sensor systems dedicated to the support of remote sensing research. Two Lockheed ER-2 (U-2S,) a DC-8, and several U.S. Dept. of Energy aircraft provide multi-level platforms for both NASA and investigator-owned sensors. Data are collected for the atmospheric, land, and ocean processes aspects of the NASA Earth Science program, as well as for universities and other government agencies. Several of these systems are being used to validate algorithms for the NASA Earth Observing System.

The NASA aircraft, located at Dryden Flight Research Center, are used as test-beds for advanced sensor design and satellite simulation, as well as to support scientific and operational data collection campaigns. Various systems are in use and under development, including eight different multispectral imaging devices, a SAR system, and a suite of large-format mapping cameras. The aircraft are equipped with GPS locational systems, and continuously record platform attitude information. All instruments are spectrally, spatially, and radiometrically calibrated on a routine basis.

The systems described here are facility NASA sensors, and are generally available to the science community. They reside at Ames Research Center and the Jet Propulsion Laboratory. There are numerous other sensors that fly on these aircraft that are owned by individual investigators, and are not within the scope of this document.

To request flights of the NASA aircraft and or use of NASA instrumentation, a Flight Request form is required. These forms are available from the Ames Research Center, ATTN.: Aircraft Programs, MS 211-17, Moffett Field CA, 94035-1000, phone 415-604-6099 (-1750 fax). For more information on the airborne programs, connect to WWW sites: <http://airsci-www.arc.nasa.gov/> or <http://www.wff.nasa.gov/~web/msn.html>.

AVIRIS (Airborne Visible and Infrared Imaging Spectrometer)

The AVIRIS is the second in a series of imaging spectrometer instruments developed at the Jet Propulsion Laboratory (JPL) for earth remote sensing. This instrument uses scanning optics and four spectrometers to image a 614 pixel swath simultaneously in 224 contiguous spectral bands.

AVIRIS parameters are as follows:

IFOV: 1 mrad
Ground Resolution: 66 feet (20 meters) at 65,000 feet
Total Scan Angle: 30 degrees
Swath Width: 5.7 nmi (10.6 km) at 65,000 feet
Digitization: 12-bits

<u>Spectrometer</u>	<u>Wavelength</u>	<u>#Bands</u>	<u>Bandwidth</u>
1	0.41 - 0.70 μm	31	9.4 nm
2	0.68 - 1.27 μm	63	9.4 nm
3	1.25 - 1.86 μm	63	9.7 nm
4	1.84 - 2.45 μm	63	9.7 nm

Notes: This instrument is flown on the ER-2 aircraft. All data collection missions are coordinated through JPL.

(See the AVIRIS homepage at <http://makalu.jpl.nasa.gov/aviris.html>)

MODIS Airborne Simulator

The MODIS Airborne Simulator (MAS) is a multispectral scanner configured to approximate the Moderate-Resolution Imaging Spectrometer (MODIS), an instrument to be orbited on the NASA EOS-AM1 platform. MODIS is designed to measure terrestrial and atmospheric processes. The MAS was a joint project of Daedalus Enterprises, Berkeley Camera Engineering, and Ames Research Center. The MODIS Airborne Simulator records fifty spectral bands, configured as follows:

Spectral Channel	Band center (μm)	Bandwidth (μm)	Spectral Range
1	0.4649	0.0397	0.4451-0.4848
2	0.5494	0.0417	0.5285-0.5703
3	0.6550	0.0511	0.6294-0.6805
4	0.7024	0.0415	0.6816-0.7231
5	0.7431	0.0420	0.7221-0.7641
6	0.8248	0.0427	0.8034-0.8461
7	0.8667	0.0414	0.8460-0.8874
8	0.9072	0.0409	0.8867-0.9276
9	0.9476	0.0397	0.9277-0.9674
10	1.6422	0.0519	1.6163-1.6682
11	1.6975	0.0505	1.6722-1.7228
12	1.7499	0.0506	1.7245-1.7752
13	1.8014	0.0491	1.7768-1.8259
14	1.8548	0.0489	1.8303-1.8792
15	1.9044	0.0487	1.8801-1.9288
16	1.9553	0.0483	1.9312-1.9794

Spectral Channel	Band center (μm)	Bandwidth (μm)	Spectral Range
26	3.1192	0.1616	3.0384-3.2000
27	3.2809	0.1486	3.2066-3.3552
28	3.4330	0.1617	3.3521-3.5138
29	3.5940	0.1539	3.5170-3.6709
30	3.7449	0.1449	3.6724-3.8174
31	3.9069	0.1602	3.8267-3.9870
32	4.0707	0.1554	3.9929-4.1484
33	4.1699	0.0669	4.1365-4.2034
34	4.4029	0.1255	4.3401-4.4656
35	4.5404	0.1512	4.4648-4.6160
36	4.6979	0.1591	4.6184-4.7775
37	4.8536	0.1516	4.7778-4.9294
38	5.0033	0.1468	4.9298-5.0767
39	5.1588	0.1400	5.0888-5.2288
40	5.3075	0.1327	5.2412-5.3738
41	5.3977	0.0755	5.3590-5.4365

17	2.0048	0.0487	1.9804-2.0291
18	2.0551	0.0484	2.0309-2.0793
19	2.1037	0.0486	2.0794-2.1280
20	2.1532	0.0483	2.1291-2.1774
21	2.2019	0.0481	2.1779-2.2259
22	2.2522	0.0486	2.2278-2.2675
23	2.3021	0.0487	2.2777-2.3265
24	2.3512	0.0476	2.3274-2.3750
25	2.4005	0.0483	2.3764-2.4246

42	8.5366	0.3950	8.3391-8.7341
43	9.7224	0.5365	9.4541-9.9906
44	10.5071	0.4579	10.278-10.736
45	11.0119	0.4710	10.776-11.247
46	11.9863	0.4196	11.776-12.196
47	12.9013	0.3763	12.713-13.089
48	13.2702	0.4584	13.041-13.500
49	13.8075	0.5347	13.540-14.075
50	14.2395	0.3775	14.051-14.428

Sensor/Aircraft Parameters:

Spectral Bands: 50 (16-bit resolution)
 IFOV: 2.5 mrad
 Ground Resolution: 163 feet (50 meters at 65,000 feet)
 Swath Width: 19.9 nmi (36 km)
 Total Scan Angle: 85.92 degrees
 Pixels/Scan Line: 716
 Scan Rate: 6.25 Hz
 Ground Speed: 400 kts (206 m/second)
 Roll Correction: Plus or minus 3.5 degrees (approx.)

(See the homepage at <http://ltpwww.gsfc.nasa.gov/MODIS/MAS/Home.html>)

MASTER (MODIS/ASTER Airborne Simulator)

The MASTER is similar to the MAS, with the thermal bands modified to more closely match the NASA EOS ASTER (Advanced Spaceborne Thermal Emission and Reflection Radiometer) satellite instrument, which is scheduled for launch in 1998. It is intended primarily to study geologic and other Earth surface properties. Flying on both high and low altitude aircraft, the MASTER will be operational in early 1998. Its fifty spectral bands are configured as follows:

Spectra l Channe l	Band center (μm)	Bandwid th (μm)	Spectral Range
1	0.460	0.04	0.440-0.480
2	0.500	0.04	0.480-0.520
3	0.540	0.04	0.520-0.560
4	0.580	0.04	0.560-0.600

Spectra l Channe l	Band center (μm)	Bandwid th (μm)	Spectral Range
26	3.150	0.15	3.075-3.225
27	3.300	0.15	3.225-3.375
28	3.3450	0.15	3.375-3.525
29	3.600	0.15	3.525-3.675

5	0.660	0.06	0.630-0.690
6	0.710	0.04	0.690-0.730
7	0.750	0.04	0.730-0.770
8	0.800	0.04	0.780-0.820
9	0.865	0.04	0.845-0.885
10	0.905	0.04	0.885-0.925
11	0.945	0.04	0.925-0.965
12	1.625	0.05	1.600-1.650
13	1.675	0.05	1.650-1.700
14	1.725	0.05	1.700-1.750
15	1.775	0.05	1.750-1.800
16	1.825	0.05	1.800-1.850
17	1.875	0.05	1.850-1.900
18	1.925	0.05	1.900-1.950
19	1.975	0.05	1.950-2.000
20	2.075	0.05	2.050-2.100
21	2.160	0.05	2.135-2.185
22	2.210	0.05	2.185-2.235
23	2.260	0.05	2.235-2.285
24	2.3295	0.065	2.297-2.362
25	2.3945	0.065	2.362-2.427

30	3.750	0.15	3.675-3.825
31	3.900	0.15	3.825-3.975
32	4.050	0.15	3.975-4.125
33	4.200	0.15	4.125-4.275
34	4.575	0.6	4.275-4.875
35	4.500	0.15	4.425-4.575
36	4.650	0.15	4.575-4.725
37	4.800	0.15	4.725-4.875
38	4.950	0.15	4.875-5.025
39	5.100	0.15	5.025-5.175
40	5.250	0.15	5.175-5.325
41	7.900	0.4	7.70-8.10
42	8.300	0.4	8.10-8.50
43	8.700	0.4	8.50-8.90
44	9.100	0.4	8.90-9.30
45	9.700	0.4	9.50-9.90
46	10.100	0.4	9.90-10.30
47	10.625	0.65	10.30-10.95
48	11.300	0.7	10.95-11.65
49	12.050	0.5	11.80-12.30
50	12.750	0.5	12.50-13.00

Sensor/Aircraft Parameters:

Spectral Bands: 50 (16-bit resolution)
 IFOV: 2.5 mrad
 Ground Resolution: 12-50 meters (variable w/ altitude)
 Total FOV: 85.92 degrees
 Pixels/Scanline: 716
 Scan Rate: 6.25 - 25 Hz

(See the homepage at asterweb.jpl.nasa.gov)

AirMISR (Airborne Multi-angle Imaging SpectroRadiometer)

This is an airborne instrument for obtaining multi-angle imagery similar to that of the satellite-borne MISR instrument, which is designed to contribute to studies of the Earth's ecology and climate. AirMISR flies on the NASA-owned ER-2 aircraft. It was built for NASA by the Jet Propulsion Laboratory in Pasadena, California.

(See the homepage at <http://www-misr.jpl.nasa.gov/armain.html>)

AIRSAR (Airborne Synthetic Aperture Radar)

This is an experimental system managed by the NASA Jet Propulsion Laboratory (JPL,) that flies on the DC-8 aircraft. It simultaneously acquires data in the L, P, and C-Bands in multiple polarizations.

The system was designed in support of the Space Shuttle Imaging Radar-C (SIR-C) program, but is widely used in the SAR remote sensing research community.

(See the homepage at <http://southport.jpl.nasa.gov/airsardesc.html>)

TMS (Thematic Mapper Simulator)

This is a Daedalus AADS-1268 scanner that flies on the ER-2 aircraft and simulates the LANDSAT TM instrument, with slightly higher spatial resolution, and several extra bands.

<u>Band</u>	<u>Wavelength μm</u>
1	0.42- 0.45
2 (TM1)	0.45- 0.52
3 (TM2)	0.52- 0.60
4	0.60- 0.62
5 (TM3)	0.63- 0.69
6	0.69- 0.75
7 (TM4)	0.76- 0.90
8	0.91- 1.05
9 (TM5)	1.55- 1.75
10 (TM7)	2.08- 2.35
11 (TM6) High Gain	8.5- 14.0
12 (TM6) Low Gain	8.5- 14.0

Spatial Resolution: 25 meters (all bands) from 19.8 km (65,000 ft.)

Total Field of View: 42.5 degrees

IFOV: 1.25 mrad

Notes: All bands are 8-bit digitization; onboard blackbody sources are carried for thermal calibration. The system is scheduled to be upgraded to 16-bit resolution in late 1998.

(See the homepage at <http://asapdata.arc.nasa.gov/Sensors.htm>)

AOCI (Airborne Ocean Color Imager)

The AOCI is a high altitude multispectral scanner built by Daedalus Enterprises, designed for oceanographic remote sensing. It provides 10-bit digitization of eight bands in the visible/near-infrared region of the spectrum, plus two 8-bit bands in the near and thermal infrared. The bandwidths are as follows:

<u>Channel</u>	<u>Wavelength, μm</u>
1	0.436 - 0.455
2	0.481 - 0.501
3	0.511 - 0.531
4	0.554 - 0.575
5	0.610 - 0.631
6	0.655 - 0.676
7	0.741 - 0.800
8	0.831 - 0.897
9	0.989 - 1.054
10	8.423 - 12.279

Spatial Resolution: 50 Meters from 19.8 km (65,000 ft.)

Total Field of View: 85 degrees

IFOV: 2.5 mrad

Note: The system is scheduled to be upgraded to 16-bit resolution in late 1998.

(See the homepage at <http://asapdata.arc.nasa.gov/Sensors.htm>)

MAMS (Multispectral Atmospheric Mapping Sensor)

The MAMS is a modified Daedalus Scanner flown aboard the ER-2 aircraft. It is designed to study weather related phenomena including storm system structure, cloud-top temperatures, and upper atmospheric water vapor. The scanner retains the eight silicon-detector channels in the visible/near-infrared region found on the Daedalus Thematic Mapper Simulator, with the addition of four channels in the infrared relating to specific atmospheric features. The spectral bands are as follows:

<u>Channel</u>	<u>Wavelength, μm</u>
1	(LSBs for Channels 9-12)
2	0.45 - 0.52
3	0.52 - 0.60
4	0.57 - 0.67
5	0.60 - 0.73
6	0.65 - 0.83
7	0.72 - 0.99
8	0.83 - 1.05
9	3.55 - 3.93 (6.20- 6.90 optional)
10	3.55 - 3.93 (" " ")
11	10.3 - 12.1
12	12.5 - 12.8

Spatial Resolution: 50 or 100 meters from 19.8 km (65,000 ft.)

Total Field of View: 85.92 degrees

IFOV: 2.5 or 5.0 mrad (selectable)

Notes: Channels 9 - 12 are digitized to 10 bits; all others are 8-bit. Blackbody sources are carried for IR calibration. The system is scheduled to be upgraded to 16-bit resolution in late 1998.

(See the homepage at <http://www.ghcc.msfc.nasa.gov/irgrp/mams>)

Electro-Optic Camera

This is a three channel framing camera designed for the ER-2, consisting of three 2048 X 2048 element, cooled silicon arrays mounted on a prism behind a single lens. The channels cover the green, red, and near-IR portions of the spectrum; each channel can be further narrowed within its respective range with a removable narrow-band filter mounted on the dichroic prism face.

<u>Channel</u>	<u>Wavelength, μm</u>
1	.525 - .570
2	.620 - .700
3	.810 - .850

Total Field of View: 60 degrees

IFOV: 0.52 mrad

Digitization: 12 bits

(See the homepage at <http://asapdata.arc.nasa.gov/Sensors.htm>)

Aerial Camera Systems

The ER-2 can carry a variety of film camera systems. Several of these cameras are calibrated for precision photogrammetry, and the film may be used to generate digital orthophotos or high-resolution digital elevation models.

<u>Camera Type</u>	<u>Lens</u>	<u>Film Format</u>	<u>Ground Coverage</u>	<u>Nominal Resolution</u>	<u>Scale</u>
RC-10	6"/f4	9" X 9"	30 X 30km	3.0-8.0m	1:130,000
RC-10	12"/f4	9" X 9"	15 X 15km	1.5-4.0m	1:65,000
HR-732	24"/f8	9" X 18"	7.4 X 15km	0.6-3.0m	1:32,500
IRIS (Panoramic)	24"/f3.5	4.5" X 35"	3.7 X 40km (Nadir)	0.3-2.0m	1:32,500

Note: Spatial parameters are for the ER-2 at 19.8km altitude; actual resolution is a function of target contrast. Missions are typically flown with 60% forward frame overlap for stereo coverage. RC-30 cameras are also available on the Dept. of Energy aircraft.

(See the homepage at <http://asapdata.arc.nasa.gov/Sensors.htm>)

STARLink

The Satellite Telemetry And Return Link (STARLink) system provides real-time, continuous relay of digital sensor data from the ER-2 aircraft via the NASA Tracking & Data Relay Satellite System (TDRSS.) It is currently configured to send 48 Mb/sec of data down to the ground station, and 400 Kb/sec simultaneously back up to the aircraft for sensor command and control. The system offers nearly global coverage, with the data being captured to disk arrays at Ames Research Center.

(See the homepage at <http://hawkeye.arc.nasa.gov>)

Other Imaging systems

The ER-2 and DC-8 aircraft are also equipped with video systems for tracking purposes, which are scheduled to be replaced by an HDTV devices.

Data Availability

All of the data collected by these systems is publicly available through U.S. Government agencies. Archives exist at the EROS Data Center of the U.S. Geological Survey in Sioux Falls, South Dakota; and within the NASA EOS-DAACs (Earth Observing System -

Distributed Active Archive Centers.) Further information is available from the NASA Ames Research Center Aircraft Sensor Facility at (650) 604-6252.

2. SPACEBORNE INSTRUMENTS

NASA maintains an active program providing imagery and digital data of the earth from space, primarily through the Earth Observation System (EOS). The primary NASA instruments currently supplying land images of the earth are the Thematic Mapper on Landsat 5 and the AVHRR on the NOAA satellites. Between now and the end of the century, several platforms will be launched that will provide the NASA research community access to land observations. These include EOS AM-1, Landsat 7, and the EO-1. In addition, NASA will have access, through cooperative agreements and data purchases, to data from Radarsat and NOAA satellites. NASA may also purchase land observation data from non-US systems, e.g., SPOT, IRS, ADEOS, JERS, etc. to meet specific requirements of NASA sponsored research through agreements between NASA and space agencies of other governments or commercial operators.

The data available from NASA sponsored, earth orbiting, land observation instruments are described below, listed alphabetically by instrument name. All the platforms are polar orbiters. For more information on the instruments marked with an asterisk (*), see the "1995 MTPE EOS Reference Handbook" available from the EOS Project Science Office, Code 900, NASA Goddard Space Flight Center, Greenbelt, MD, 20771, the URL "<http://eosps0.gsfc.nasa.gov>" and/or the URL listed with the description of the instrument.

Advanced Land Imager (ALI)

Platform: EO-1

Launch Date: May 1999

The ALI is an experimental push broom spectrometer designed to test components for a possible Landsat 7 follow-on instrument. The spectral and spatial characteristics of the instrument are based on providing continuity with the ETM+ (see below) plus hyperspectral imaging. At present the operational availability is limited to one year due to funding.

Swath width = Pan 36 km; Multispectral 36 km; Hyperspectral 9.6 km.

Spectral/Spatial resolution = Pan (.5-.7 μm), 10 m; VNIR (8 channels .433-1.75 μm), 30 m; SWIR (1 channel 2.08-2.35 μm), 30 m; Hyperspectral (315 variable bandwidth samples .40-2.50 μm) 30 m.

For more information: <http://www710.gsfc.nasa.gov/~nmp-eo1/eo1.html>

Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER)*

Platform: EOS AM-1

Launch Date: June 1998

ASTER will provide high spatial resolution multispectral images of the earth's surface and clouds. The instrument is a multispectral imager that will record reflected and emitted radiation of the earth's surface. ASTER will have 4% absolute radiometric accuracy in the VNIR and SWIR bands, and absolute temperature accuracy of 3 K in the 200-240 K range, 2 K in the 240-270 K range, 1 K in the 270-340 K range and 2 K in the 340-370 K range in the thermal infrared bands.

Swath width = 60 km at nadir; swath center is pointable cross-track ± 106 km for SWIR and TIR, ± 314 km for VNIR
Spectral/Spatial resolution = VNIR (3 channels 0.5-0.9 μm), 15 m [stereo (0.7-0.9 μm), 15 m horizontal, 25 m vertical]; SWIR (6 channels 1.6-2.43 μm), 30 m; TIR (5 channels 8-12 μm), 90 m.

For more information: <http://asterweb.jpl.nasa.gov/>

Advanced Very High Resolution Radiometer (AVHRR)

Platform: NOAA series

Launch Date: On-going operational program

AVHRR is a five channel scanning radiometer that provides general, daily coverage of the earth.

Swath width = >2600 km

Spectral/Spatial resolution = VNIR (2 channels .58-1.10 μm), 1.1 km or 4.0 km; TIR (3 channels 3.55- 12.50 μm), 1.1 km or 4.0 km.

For more information: <http://www2.ncdc.noaa.gov/POD/>

Clouds and the Earth's Radiant Energy System (CERES)*

<u>Platform</u>	<u>Launch Date</u>
TRMM	November 1997
AM-1	Mid 1998
PM-1	December 2000

The CERES is comprised of two broadband scanning radiometers: one cross-track mode, and one rotating plane (bi-axial scanning), except for the first CERES launched on TRMM. The TRMM model has only one radiometer, which is capable of being operated in either the cross-track or the bi-axial mode. CERES will measure both solar-reflected and Earth-emitted radiation from the top of the atmosphere to the surface. It will also determine cloud properties including the amount, height, thickness, particle size, and phase of clouds using simultaneous measurements by other instruments.

<u>Spectral Bands</u> (Channels)	0.3 to 12 microns
<u>Swath</u>	Limb to limb
<u>Spatial Resolution</u>	21 km at nadir
<u>Mass</u>	90 kg [two scanners]
<u>Duty Cycle</u>	100%
<u>Power</u>	Power: 103 W (average), 106 W (peak) [two scanners]
<u>Data Rate</u> (Kbps)	20.00 (2 scanners)

For more information: <http://asd-www.larc.nasa.gov/ceres/ASDceres.html>

Enhanced Thematic Mapper Plus (ETM+)*

Platform: Landsat 7

Launch Date: May 1998

The ETM+ instrument is a whiskbroom scanning radiometer that will provide synoptic, repetitive, multispectral, high resolution, digital images of all land surface of the earth. The instrument draws substantially on the heritage of the Landsat program, especially the Thematic Mapper instrument, but will offer improvements over previous instruments in the

program, e.g., 5% absolute radiometric calibration, 15 m panchromatic band and 60 m thermal band. ETM+ imagery over the United States will be collected every 16 days and made available to users within 24 hours of acquisition at the primary US ground station - EROS Data Center in Sioux Falls, South Dakota.

Swath width = 185 km

Spectral/Spatial resolution = Pan (.5-.9 μm), 15 m; VNIR (4 channels .45-.90 μm), 30 m; SWIR (2 channels 1.55-2.35 μm), 30 m; TIR (1 channel 10.42-12.50 μm), 60 m.

For more information: <http://geo.arc.nasa.gov/sge/landsat/17.html>

Multi-angle Imaging SpectroRadiometer (MISR)*

Platform: EOS AM-1

Launch Date: June 1998

The MISR uses nine individual charge coupled device (CCD) based pushbroom cameras to observe the earth at nine discrete view angles - nadir and eight other symmetrical views.

Swath width = 360 km

Spectral/Spatial resolution = VNIR (4 channels .443-.865 μm), 275 m, 550 m, and 1.1 km.

For more information: <http://www-misr.jpl.nasa.gov/>

Moderate-resolution Imaging Spectroradiometer (MODIS)*

Platform: EOS AM-1

Launch Date: June 1998

MODIS is an EOS facility instrument designed to measure biological and physical processes on a global basis every 1-2 days. The instrument will generate simultaneous, congruent observations of high-priority atmospheric, oceanic and land surface features.

Swath width = 2300 km at 110°

Spectral/Spatial resolution = 36 channels (21 at .4-3.0 μm ; 15 at 3.0-14.5 μm), 250 m, 500 m, 1 km.

For more information: <http://ltpwww.gsfc.nasa.gov/MODIS/MODIS.html>

RADARSAT

Platform: RADARSAT

Launch Date: Operational since 1995; RADARSAT-2: 2000

RADARSAT is a C-band synthetic aperture radar (SAR) system operated by Canada. The instrument provides images of any part of the earth's surface irrespective of clouds with a 1-10 day revisit interval dependent on the latitude and configuration of the sensor.

Swath width = 50-500 km

Spectral/Spatial resolution = Frequency/polarization = C/HH; 10-100 m.

For more information: <http://www.rsi.ca/>

Vegetation Canopy Lidar (VCL) Mission

Platform VCL Platform

Launch Date: February 2000

The principal goal of the VCL mission is the characterization of the three-dimensional structure of the Earth. The two main science objectives are: 1) landcover characterization for terrestrial ecosystem modeling, monitoring and prediction, and for climate modeling and prediction; and 2) global reference data set of topographic spot heights and transects. The Measurement Objectives are:

- Vegetation canopy top height < 1 m
- Vertical distribution of intercepted surfaces
- Ground surface topographic elevations < 1m
- Measurement transects are globally gridded to 2 km x 2 km data products
-

The VCL instrument consists of 3 - 5 Nd:YA diode-pumped pulsed lasers operating at: 290 pps (land), 10 mJ per pulse, 1064 nm wavelength with a projected lifetime of 2 years.

Swath width = 8 km

Resolution = 25 m (60 μ rad) footprint diameter at 400 km altitude

Track Spacing = 2 km

Elevation Accuracy < 1 m in low slope terrain

Vegetation Height Accuracy < 1 m limited by 100:1 pulse detection dynamic range and cal/val.

For more information: <http://essp.gsfc.nasa.gov/>

3. TELEMETRY AND CALIBRATION

STARLink - The Satellite Telemetry And Return Link (STARLink) system provides real-time, continuous relay of digital sensor data from the ER-2 aircraft via the NASA Tracking & Data Relay Satellite System (TDRSS). STARLink is currently configured to send 48 Mbps of data down to the ground station, and, simultaneously, to receive from the ground 400 Kbps of sensor command and control. The system offers nearly global coverage. Data received is captured on disk arrays at Ames Research Center.

Calibration Laboratory - The calibration laboratory for airborne sensors at Ames Research Center provides spectral and radiometric characterization of the instruments with traceability to the National Institute of Standards and Technology (NIST). Measurements can be performed in the spectral range of 350 nm to 15 microns. Laboratory assets include a monochromator, spectrometer, spectrophotometer, Fourier transform infrared spectrometer, a variety of "standard sources" and an environmental chamber.

4. DATA SYSTEMS

EOSDIS V0 - The Earth Observing System Data and Information System (EOSDIS) is a comprehensive data and information system designed to perform a wide variety of functions in support of a national and international user community. EOSDIS will command and control satellites and instruments and will generate data sets from satellite and in situ observations. Services provided by EOSDIS include: data archive, distribution

and management; information management; product generation; spacecraft command and control; and data capture and telemetry processing. NASA is implementing EOSDIS using a distributed, open systems architecture. This approach allows for the allocation of EOSDIS elements to various locations to benefit from different institutional capabilities and scientific expertise.

For an overview of EOSDIS see URL: http://spsosun.gsfc.nasa.gov/New_EOSDIS.html and for more information or to connect to Version 0 (V0) of the EOSDIS information management system (IMS) use the URL: <http://harp.gsfc.nasa.gov/~imswww/pub/imswelcome/>. Additional information on EOSDIS users can be found in the "Proceedings of the EOSDIS Potential User Group Development Effort Conference" on the URL: <http://rsrunt.geog.ucsb.edu/eosdis.html>.

DAACs - The eight Distributed Active Archive Centers (DAACs) selected by NASA to carry out the processing, archiving, distributing the EOS and related data and providing user support are listed in the below table. The table includes a contact for the EOSDIS Earth Science Information management System (IMS) which provides a central interface for earth science data. The table also contains a listing for NOAA's Satellite Active Archive (SAA), which contains NOAA's Polar-orbiting Operational Environmental Satellites (POES) real-time and historical satellite data.

	ADDRESS
EOSDIS IMS EOSDIS Information Management System http://harp.gsfc.nasa.gov/v0ims/ <i>The IMS provides search and order tools for accessing a wide variety of global Earth science data and information held at ten different EOSDIS and NOAA data centers.</i>	IMS Science and Operations Support 7701 Greenbelt Road, #400 Greenbelt, MD 20770 301-441-4197 voice 301-441-2392 fax Internet: closs@eos.nasa.gov
ASF Alaska SAR Facility (Alaska, USA) http://www.asf.alaska.edu/ <i>Sea Ice, Polar processes, SAR products</i>	ASF DAAC User Services Alaska SAR Facility University of Alaska PO Box 757320 Fairbanks, AK 99775-7320 907-474-6166 voice 907-474-5195 fax Internet: asf@eos.nasa.gov
SEDAC / CIESIN Socioeconomic Data and Applications Center Consortium for International Earth Science Information Network (Michigan, USA) http://sedac.ciesin.org/ <i>Human Interactions in the Environment</i>	2250 Pierce Rd. University Center, MI 48710 517-797-2727 517-797-2622 Internet: ciesin.info@ciesin.org
EDC EROS Data Center (South Dakota, USA) http://edcwww.cr.usgs.gov/landdaac/landdaac.html <i>Land processes Imagery</i>	EDC DAAC User Services U.S. Geological Survey EROS Data Center Sioux Falls, SD 57198 605-594-6116 voice 605-594-6963 fax Internet: edc@eos.nasa.gov

GSFC Goddard Space Flight Center (Maryland, USA) http://daac.gsfc.nasa.gov/DAAC_DOCS/gdaac_home.html <i>Upper Atmosphere, Global Biosphere, Atmospheric Dynamics, Geophysics</i>	User Services Office, Code 902.2 Distributed Active Archive Center Goddard Space Flight Center Greenbelt, MD 20771 301-614-5224 voice 301-614-5268 fax Internet: gsfc@eos.nasa.gov
JPL Jet Propulsion Lab (California, USA) http://podaac-www.jpl.nasa.gov/ <i>Physical Oceanography</i>	JPL Physical Oceanography DAAC User Services NASA/Jet Propulsion Laboratory MS 300-320 4800 Oak Grove Drive Pasadena, CA 91109 818-354-9890 voice 818-393-2718 fax Internet: jpl@eos.nasa.gov
LaRC Langley Research Center (Virginia, USA) http://eosweb.larc.nasa.gov/ <i>Radiation Budget, Tropospheric Chemistry, Clouds, Aerosols</i>	Langley DAAC User Services NASA Langley Research Center Mail Stop 157D Hampton, VA 23681-0001 757-864-8656 voice 757-864-8807 fax Internet: larc@eos.nasa.gov
NSIDC National Snow and Ice Data Center (Colorado, USA) http://www-nsidc.colorado.edu/NASA/GUIDE/ <i>Snow and Ice, Cryosphere and Climate</i>	NSIDC DAAC User Services National Snow and Ice Data Center CIRES, Campus Box 449 University of Colorado Boulder, CO 80309-0449 303-492-6199 voice 303-492-2468 fax Internet: nsidc@eos.nasa.gov
NOAA-SAA National Oceanic and Atmospheric Administration - Satellite Active Archive (Maryland, USA) http://www.saa.noaa.gov/ <i>Disciplines: Satellite Data (Atmosphere, Land, Ocean, Earth Sciences, Remote Sensing)</i>	NOAA/NESDIS Satellite Active Archive (Suitland, MD) 5627 Allentown Road, Suite 100 Princeton Executive Suites Suitland, MD 20746 NOAA-SAA User Services NESDIS/NCDC National Climatic Data Center 151 Patton Avenue Asheville, NC 28801-5001 USA 704-271-4850 voice 704-271-4876 fax Internet: saainfo@nesdis.noaa.gov
ORNL Oak Ridge National Lab (Tennessee, USA) http://www-eosdis.ornl.gov/ <i>Biogeochemical Dynamics</i>	ORNL DAAC User Services Office Oak Ridge National Laboratory PO Box 2008, Mail Stop 6407 Oak Ridge, TN 37831-6407 423-241-3952 voice 423-574-4665 fax

RACs - A list of current Regional Application Centers are provided in the below table. The goal of NASA's Regional Application Center Program (RAC) is to foster the self supporting use of environmental and Earth resources data (from satellites and other sources) by regional institutions in an effort to enhance knowledge of earth systems science. The RACs are a collaboration with NASA via a Memorandum of Understanding (MOU), receive no direct funding from NASA and are located regionally at universities with established remote sensing programs. The university RACs test NASA technologies in real-world applications, preferably in partnership with state and local agencies, universities, and value-added commercial companies, and provide feedback to NASA's satellite derived data. The universities also provide their environmental data holdings to NASA for validation of satellite sensors and global climate change research.

RAC	
Bowling Green State University Attn: Robert Vincent Department of Geology Bowling Green OH 43403-0218	<u>Phone:</u> 419-372-0160 <u>Email:</u> rvincen@bgnet.bgsu.edu
Clemson University Attn: Walt Ligon ECE Department 102 Riggs Hall P.O. Box 340915 Clemson SC 29634-0915 <u>Homepage:</u> http://ece.clemson.edu/parl/	<u>Phone:</u> 864-656-1224 <u>Email:</u> walt@eng.clemson.edu
Eastern Shore of Maryland Technical Center of Excellence (TCE), consisting of: WYE Research Laboratory University Maryland Eastern Shore Washington College Chesapeake College Talbot County, Maryland Talbot Chamber of Commerce 3DI Geographic Technologies Attn: Monty Deel	<u>Phone:</u> 410-820-4363, ext. 212 <u>Email:</u> mdeel@3DImaging.com
Florida International University Attn: Martha Gutierrez Spatial Data Processing Manager NASA Regional Application Center School of Computer Science, ECS 243 University Park Campus Miami FL 33199	<u>Phone:</u> 305-348-1706 <u>Email:</u> mgutie01@cs.fiu.edu
James Madison University Attn: Stephen E. Wright Center for Geographic Information Science Harrisonburg, VA 22807 <u>Homepage:</u> http://ntsl.csjmu.edu/nasa	<u>Phone:</u> 540-568-3154 Fax: 540-568-2761 <u>Email:</u> barnesjl@jmu.edu
Rutgers University Attn: Dr. Nabil R. Adam	<u>Phone:</u> 973-353-5239 <u>Fax:</u> 973-353-5003

CIMIC 180 University Ave. Newark NJ 07102	<u>Email:</u> adam@adam.rutgers.edu
U.S. Naval Academy Attn: Randy Seftas 590 Holloway Road Aerospace Engineering Department Annapolis MD 21402-5042	<u>Phone:</u> 410-293-4380 <u>Email:</u> sertas@nads.navy.mil
University of Cayuga County, NY Attn: Bob Brower 5th Floor County Office Building 160 Genesee Street Auburn NY 13021	<u>Phone:</u> 315-253-1276 <u>Email:</u> bbrower@relex.com
University of Hawaii at Manoa Attn: Norman Okamura Social Science Research Institute 2424 Maile Way, Porteus Hall 704 Honolulu HI 96822 <u>Homepage</u> http://www.mrtc.org/prvc/	<u>Phone:</u> 808-956-2909 <u>Email:</u> norman@elele.peacesat.hawaii.edu
University of Kansas Attn: Kevin P. Price Associate Professor, Geography & Associate Director Kansas Applied Remote Sensing (KARS) Program 2291 Irving Hill Road Lawrence KS 66045	<u>Phone:</u> 913-864-7723 (KARS) <u>Fax:</u> 913-864-7789 <u>Email:</u> kprice@falcon.cc.ukans.edu
University of Maryland - Baltimore County Attn: Tim Foresman Department of Geography 5401 Wilkens Avenue Baltimore MD 21228 <u>Homepage:</u> http://www.cs.umbc.edu/~motteler/research/rdc/index.html	<u>Phone:</u> 410-455-3149 <u>Email:</u> foresman@umbc.edu
University of Nebraska - Lincoln Attn: Don Rundquist Center for Advanced Land Management 113 Nebraska Hall Lincoln NE 68588-0517	<u>Phone:</u> 402-472-7536 <u>Fax:</u> 402-472-2410 <u>Email:</u> dr1000@tan.unl.edu
University of Southwestern Louisiana Attn: Margaret Francis Center for Advanced Computer Studies 2 Rex Street Lafayette LA 70504 <u>Homepage:</u> http://hvwwww.cacs.usl.edu/Departments/CACS/RVC/index.h tml	<u>Phone:</u> 318-298-6598 (24 Hour Number) <u>Email:</u> mmf@cacs.usl.edu
University of Southwestern Louisiana Ann: Duane Blumberg, Dean College of Sciences P.O. Box 43290 Lafayette LA 70504	<u>Phone:</u> 318-482-6986 <u>Fax:</u> 318-6195 <u>Email:</u> dblumberg@usl.edu

APPENDIX G: USGCRP Issues

- **Agriculture**: This sector includes all issues relating to the effects of global change on food production, processing, delivery, and consumption, including, for example: food supplies; food demands and preferences; affordability of and accessibility to food; trade in food products; climate and carbon dioxide effects on crops and livestock; interactions with pests; changes in soils and soil erosion; water demand and use; livestock waste and runoff; fertilizer and pesticide use; the likelihood of international transmission of livestock disease vectors; agricultural competitiveness; and the agricultural economy and its effects on communities.
- **Forests**: This sector includes all issues relating to the effects of global change on forests and related lands and associated societal and environmental uses and products derived from these lands, including, for example: public and private forest lands and related grasslands; biological, hydrological, and chemical/biogeochemical functions of forests; forest ecosystem goods and services, including recreation, aesthetics, water quantity and quality, air quality, and production of forest products; mitigation of floods and droughts and moderation of winds and waves; wildlife refuges/habitat for non-game species and habitat for game fish, birds, and mammals; protection of endangered species and maintenance of biological diversity to preserve genetic resources; sustainable forest management; and ethical issues of preserving natural and pristine areas.
- **Water Resources**: This sector includes all issues relating to the effects of global change on water from perspectives of societal and ecosystem needs, including, for example: the quantity and quality of water available for withdrawal purposes from both surface- and ground-water systems; the chemical characteristics of those waters, especially as related to human health and other uses; and the hazards posed by hydrologic extremes (floods and droughts), both in terms of water quantity and quality. The scope also includes issues of regional distribution.
- **Coastal Zone**: This sector includes all issues relating to the effects of global change on the coastal zone, including for example: wetlands and biological diversity; city and community infrastructure; coastal and estuarine fisheries and aquaculture; near and off shore resource extraction; aquifers and salinity intrusion; tourism and recreation; wildlife and migratory species; air and water quality; toxic and algal blooms; health; etc.
- **Human Health**: This sector includes all issues relating to the effects of global change on human health, including, for example: the effects of air pollution coupled with heat stress; environmental and occupational exposures related to new technologies and changing patterns of use of old technologies; expanded ranges of infectious diseases; reduced biodiversity; effects of changes in the food supply and quality and quantity of water; and the effects of changes in weather extremes.
- **Urban Areas**: This sector is focused on the places where concentrations of people live, the quality of life in those places, and the services that people expect from them, including, for example: housing; health and environmental quality; institutional infrastructure; commerce, industry, and business activities; flows of goods and services; financial infrastructure and activities; social activities and infrastructure; human services (comfort, convenience, and mobility; land housing, energy, water; sanitation and waste disposal; education; health care; security; recreation); and linkage infrastructures such as transportation and communication.

APPENDIX H: Project Performance Metrics

The Government Performance Results Act (GPRA) requires that all Government funded projects report their accomplishments and the resulting impact these accomplishments have on the socio-economic well-being of society and the Nation. To respond to this requirement, the RESACs shall submit, as part of their Annual Progress Report or on a as required basis, Project Performance Metrics consisting of the following information:

Description:

Summary of the project written for an outside audience i.e., reader who is not intimately familiar with the technology, science, applications and techniques.

Project Work Location:

Geographic location where the work is actually being performed.

Inputs:

All the inputs that are needed to complete and carry out the project. This includes human and physical capital and materials required for the research and applications process. It describes the cost of doing business and includes: budget, number of researchers/teams, participating users, data required, and use of other assets e.g., ancillary data.

Outputs:

Immediate observable products of the research and applications activity. Describes the efficiency resulting from the use of the resources. Includes data sets and applications developed, models developed, number of presentations made, papers published, number of graduate students supported (if applicable), and other direct results of the project.

Outcome:

Longer term results to which the program contributes. Includes understanding gained, applications demonstrated, resulting programmatic decisions enabled as a result of these applications. Examples included outcome such as “the rate of growth of the northern forest was accurately measured for the first time”.

Impact:

This section discusses the total consequences of the program, including intended benefits and unintended positive results. Includes description of utility and socio-economic benefit to the end users/customers. This section shall answer questions such as: Why were the results of the projects useful? How were they useful? How were the end results (i.e., applications and data products developed) used in decision-making? What kind of significant economic or policy consequence resulted from the project? Most important of all—it answers the question: **“So what?”** Includes assessments such as new knowledge shared, cost saved, new applications or functions that were done that were not possible before. How did or would the results impact the public good or expanded commercialization of value-added Earth Science data.